A WEAK RADIO-ACTIVE SUBSTANCE

(*A preliminary note*)

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Plate XVIII

ABSTRACT. The radio-active property of one of the constituents described in the author's pamphlet, "Twin Elements in Travancore Monazite," has been detected. The constituent appears to emit α-rays. A rough estimate of its average life has been given

The mineral monazite contains two interesting constituents possessing similar chemical properties. Their similarity, being also manifested in the formation of gaseous and volatile derivatives, facilitates their separation from the remaining constituents of the mineral. One of the two constituents is weakly radio active, but its radio-activity is masked when it remains mixed with the other constituent. Its radio-activity has been detected with the α-electroscope and with the help of the photographic plates as well

An electro-chemical deposit of the substance on aluminium was employed for detecting its radio-activity. In connection with the electroscope employed for the purpose of detection the stage in the ionization chamber, used for placing a radio-active source had to be fixed within a few millimetres from the upper disc carrying the leaf of the electroscope. The radio-activity found with such an arrangement and using a source, 8 cms. in diameter, was about 2 units (arbitary scale) while the natural leak of the instrument was about 5 units (of the same scale). For the purpose of photographic detection a source of the above kind and also a solution of a gaseous electrolytic product obtained from the same radio-active substance, put directly in contact with a photographic plate and thus infected, were employed. In the former case the photographic plate was placed at about 3 mm. above the source, and was exposed to its radiation with or without an intervening screen for a period (in most cases) of 60 days. Figure 1, plate XVIII refers to a case of an intervening screen, made with two strips of aluminium foil of 10μ in thickness and placed in the form of a cross, almost touching the photographic plate. The shadow cast by the strips appears in the plate. Figure 2 refers to a case without any intervening screen. The plate appears apparently blank, but under a microscope it shows a number of dots as shown by figure 3, a micro-photograph of these dots. The micro-photograph shows however two kinds of dots, large and small. The large dots can be conveniently seen even with a magnification of 50 times. A count of these large dots has been made.

In a particular plate the dots were distributed in the following manner, count being made at different distances from a point corresponding to the centre A of the source :

at 2 cms. an average of 0·81 per sq. mm.

at 4 ,, ,, 0·71 ,, ,, ,,

at 6 ,, ,, 0·71 ,, ,, ,, .

Similar count in two different plates, exposed to the same source for the same period of 60 days but one period following the other, has given the following values.

One exposed from the 4th April to 3rd June gave an average of 1·62 dots per sq. mm. while the other exposed from the 13th August to the 12th October gave an average of 0·81 dots per sq. mm. The mean interval of time between the two exposures is 123 days, *i.e.*, 13 days less than the half-value period of polonium *viz*, 136 days. Presuming each dot to represent an impact with one α-particle, the large dots may reasonably be ascribed to polonium, since they seem to diminish by one-half during about the interval of the half-value period of polonium.

The small dots have been ascribed to a different variety of the α-rays. By infecting a photographic plate with a solution of the same radio-active material after it was allowed to stand for a few months before it was so used, two kinds of α-ray tracks, long and short, have been found. Figure 4 refers to a plate infected with a gaseous product of electrolysis, obtained from the said radio active material, and kept (after being infected) in the dark for a period of three months. For the observation of the tracks a magnification of seven to eighteen hundred times has been employed. It appears that the length of the short track is almost half the length of the long one. Ascribing the long tracks to polonium, the average life of its associate giving short tracks comes out to be very much longer than 10^{20} years.

It may be remarked that the photographic plate relating to figure 2, exposed without an intervening screen, is clear and practically free from fog. The absence of fog indicates the absence of the β-radiation. There exists, however, a dark background in the photograph relating to figure 1, exposed with an intervening screen. The darkening effect is evidently due to the δ rays emerging from the aluminium foil and arising from its impact with the α-rays from the source.

We may mention that the radio-active material is responsive to some of the chemical tests of polonium, visible to the naked eye, and has a reference to the substance described in author's pamphlet, "Twin elements in Travancore Monazite" where its radio-activity has been anticipated.

In conclusion I beg to thank Mr. C. R. Bose for helping me by counting the dots relating to figure 2 and also Mr. B. C. Shome and Dr. S. Hedayetullah of the Manipur Agricultural Farm, Dacca, for the micro-photographs.

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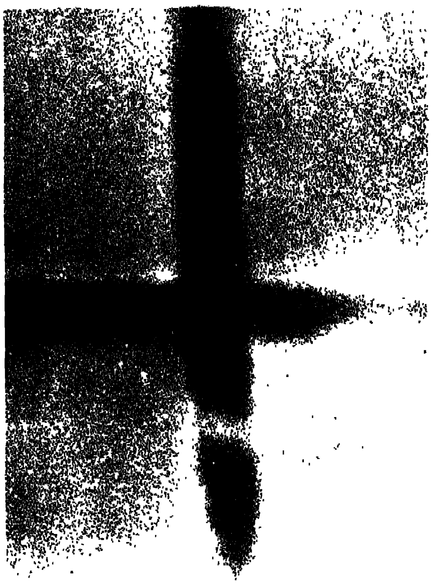

Figure 1.

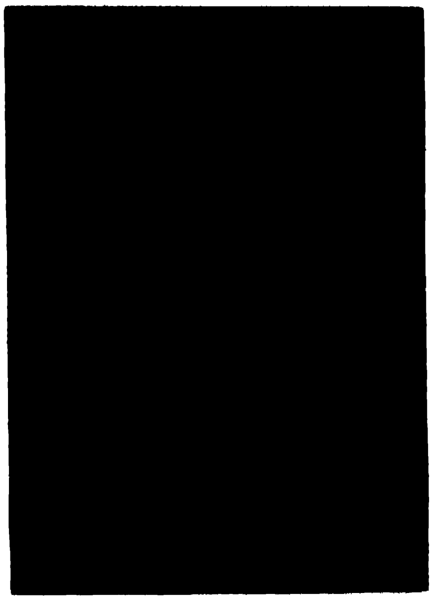

Figure 2.

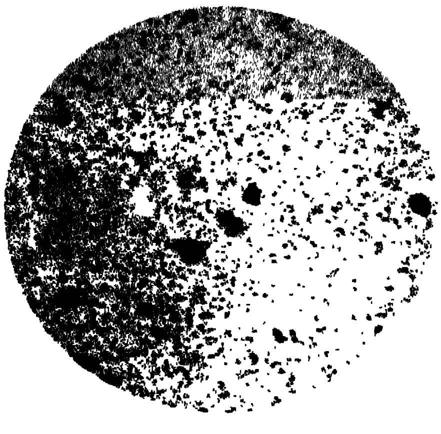

Figure 3.

S represents small dots
L ,, large ,,

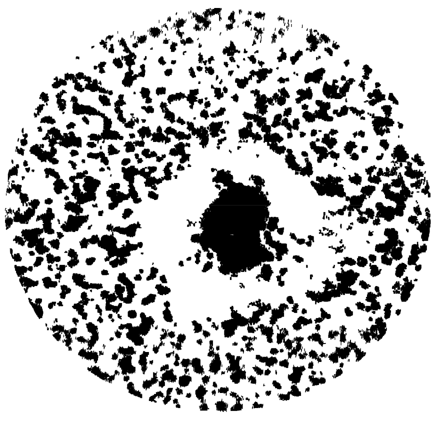

Figure 4.

L L represents long track
S ,, short ,,